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distance might be passed over in a very few days. Floating ice seems to be the impediment most likely to be met with, but a screw-propelled ship might be able to make way through it, without much danger of sustaining damage, and in this way the Pole might possibly be reached.

Persons familiar with Arctic navigation would have the benefit of local knowledge, though possibly such knowledge may hardly justify such an attempt. This paper has been suggested by observations of continuous winds in many parts of the world, of their places of termination, and the climates of those places. The south-west monsoon, blowing towards the Himálaya Mountains, readily takes a ship into the Bay of Bengal, and the trade-winds waft vessels across both the Atlantic and Pacific Oceans. A wind blows from Victoria Land, in the Antarctic Ocean, to the mountains about Cape Horn, which are warm in the winter, evidently because vapour is condensed there in great abundance; and the wind is the strongest when it approaches the locality of condensation. If, as is very probable, there be similar elevated land near the North Pole, it is likely that a ship might reach that land with greater ease than when passing from Victoria Land to Cape Horn.

2. *Surveys in Norway.* By Professor HOLST, Christiania. Translated from the Norwegian by DR. SHAW.

IN the Budget of the Norwegian Diet is found an article on the progress of the Geographical Survey of that country, from its beginning to the year 1859, accompanied by a review of the results attained; which statements will be of interest to many more than to those few into whose hands a copy of the Government's treatise may fall, and which therefore is communicated here.

The Survey was founded in the year 1779 by General Huth, Chief of the Danish and Norwegian Engineer and Artillery Corps, and in that year the officers appointed to the task, Lieuts. D. Vibe and Rick, after having received the necessary instructions, repaired to Norway. A base was measured during the winter on the ice of the Miös, on which the trigonometrical net was constructed, and later, on the ice of the Lakes of Fømund, Storsøe, and other lakes. Astronomical observations were likewise made by the above-mentioned officers. While these were employed from 1780 to 1790 on the survey of the kingdom, especially along the frontier districts, it was resolved that a Hydrographic Survey should, at the same time, be carried on, in order to obtain exact charts of the southern coasts. For this task Lieut. Growe of the Royal Navy and Lieuts. N. Vibe and Aubert were selected. This survey was commenced in 1788 and concluded in 1799. The result was 7 engraved charts of the tract between Drontheimsled and Idefjord, with descriptions of the coast and of the country around. At that time the survey was placed under the Revenue Board of Denmark, and the King, as proprietor of Laurvig, in the year 1807 commanded that very special charts should be taken of this district also. Besides this, the surveys were continued in the districts of Drontheim and Hedemark and along the frontier of the kingdom, and executed on a large scale; it being thought necessary to have very special maps of those districts in which the contests between Norway and Sweden had generally taken place. The surveys were, however, often delayed, partly from want of means, especially during the last war. After the union of Norway with Sweden the task was placed under the Department of Finance, Commerce, and Customs, and afterwards under that of the Home Department. When, in 1826, so much of the east and south of the country had been specially measured, that maps of the districts could be made, Captains Munthe and Ramm undertook this task, as a *private* enterprise; and six maps, comprising the districts of

Akershuus, Smaalenenes, Yarlsberg, Laurvig, and Hedemark, were published in France. These copperplates have been since purchased by Government and placed under the Committee of Surveys. The above-mentioned maps were published between 1826 and 1832.

In 1841, when fresh materials were acquired, the Finance Department resolved to have the maps of the districts continued and published at the expense of Government, and Captain Gjessing of the Royal Artillery was charged with the execution; he has since finished eight maps, representing the districts of Christiania, Buskerud, and Bratsberg, and the northern part of Nedenæs, and Robygdelaget districts. The want of trustworthy charts of the coasts of Nordland and Finmark being felt, in 1828 an expedition was fitted out for the purpose of supplying this deficiency, and furnished with most excellent instruments. The foundation of this survey was laid by MM. Hagerup, Paludan, and Vibe, and the work was concluded in 1844; and the survey of the tract of coast from Drontheim to Jacob River, which forms the boundary towards Russia, was afterwards completed. During several years a small Astronomical Observatory had been established at Tromsø under the superintendence of M. Due. In 1832 Professor Hansteen and Major Vibe undertook a journey to Drontheim in order to verify by observations the triangulation founded on the earlier trigonometrical points, which extended over the regions of the northern coasts. Sufficient materials having been accumulated to publish charts of the coasts of Nordland and Finmark, Government entrusted Major Vibe with this enterprise, and from 1832 to 1848 he constructed ten special and two general charts with descriptions of the whole northern coast. The charts of the coasts were lithographed in Christiania.

Numerous measurements of heights have been also made, and, together with other observations by scientific travellers, collected by Vibe and published in Keilhaus' 'Gæa Norvegia.' A continuation, containing the measurement of heights taken during the past years, is in progress. In 1841, 1842, and 1844, an expedition was fitted out under the command of the present Postmaster-general, M. Motzfeldt, to sound and examine, in connection with the fisheries on the northern coasts, the often mentioned bank of the "Havbroen," "Seabridge." In 1835 a new line was measured on the ice of the Christiania fiord by Colonel Broch. It was put in communication with the Observatory, and with Kongsvinger, through which the first meridian of the kingdom is drawn. Later two great series of triangles were carried on to Drontheim and Bergen; the first in the years 1835 and 1836 by Colonel Broch, the latter in 1852 and 1853 by Captain F. Naser. On these series of triangles all later trigonometrical measures are founded.

In 1842 a connection with the Swedish triangulation was formed across Fredrikshald by Vibe; and in 1858 a similar one across Kongsvinger by Naser. In 1845 Struve, the Director of the Observatory at Pulkowa near St. Petersburg, applied to Government for the co-operation of Norway in a great measurement, which should comprise a meridional arc of more than 25° of latitude, viz., from Ismail on the Black Sea to the northern boundary of Finmark. Both Norway and Sweden were willing to conduce to this scientific end, and the guidance of the Norwegian portion of the work was undertaken by Professor Hansteen, and that of the Swedish by Professor Selander. In the years from 1836 to 1850 inclusive, this measurement of degrees was completed, as far as Norway was concerned. The operators were Lieut.-Colonels Klouman and Lundh, and the Swedish Doctor Lindhagen, at that time holding a place at the Observatory at Pulkowa. In 1854 at the northern extreme point of this meridional arc a monument was erected at Fuglenaes near Hammerfest. In order to attain a final determination concerning the measurements, Professor Hansteen met in 1853 in Stockholm both Struve and Selander, and, besides other preliminary writings on this subject, the two first folio volumes

of the following work were published in 1856 and 1857 : "Arc du Méridien de 25° 20' entre le Danube et la Mer Glaciale, mesuré depuis 1816 jusqu'en 1855, sous la direction du Comte de Tenner, Lieut.-Général de l'Etat Major Impérial de Russie ; Chr. Hansteen, Directeur du Département Géographique Royal de Norvège ; N. H. Selander, Directeur de l'Observatoire Royal de Stockholm ; F. G. W. Struve, Directeur de l'Observatoire Central Nicholas de Russie."

Christiania Observatory being the initial point of issue for the trigonometrical survey of the kingdom, the exact determination of its situation is of the very greatest importance. A chronometric expedition was undertaken by Professor Hansteen in 1847, between Christiania and Copenhagen, for the determination of the difference of longitude of these cities. The results of this expedition, furnished with twenty-one chronometers, which were carried twelve times forward and backward between the above mentioned cities, are given in the work by Hansteen and Fearnley, entitled 'Description and Situation of the University's Observatory at Christiania, 1849.'

However excellent the older charts of the coasts of southern Norway were, new ones, corresponding with the progress of science, were highly desirable ; and Major Vibe having been charged with their construction made five special and one general chart of the coast from the Swedish frontier to Christiansand, during 1851 to 1856. They are accompanied by descriptions of the coast and land. The work has since been carried on by Lieut. Schie of the Engineers, who in four charts has farther represented the coast towards the west, past Egersund. The two general maps of Northern Norway, by Professor Munch, were published by the Ordnance Office.

1. The triangulation extends over the dioceses of Christiania and Christiansand and over parts of Bergen and Drontheim, also over the coast of Nordland and Finmark. The number of signals erected, and other points, the position of which has been trigonometrically determined, amount to 3900.

2. Of drawn trigonometrical skeleton maps there are 270.

3. Manuscripts containing astronomical observations, trigonometrical tables, co-ordinate calculations, determinations of declination, hypsometrical and other measurements, soundings, descriptions, with many other manuscripts, amount to 550 volumes.

4. In detail are completely measured the dioceses of Christiania and Christiansand ; of the diocese of Bergen 140, and of that of Drontheim 110 geographical square miles. The whole of the measured area in south Norway may be estimated at 1070 Norwegian or about 2410 geographical square miles.

5. This detailed measurement is contained in about 2800 sketch-maps with appertaining special descriptions.

6. Besides the maps finished, large maps have likewise been drawn, each comprising about 25 Norwegian square miles. Thirty-eight such maps have then been made, comprising altogether 850 Norwegian, or about 1910 geographical square miles.

7. The coast has been hydrographically examined ; in the first place all along southern Norway, afterwards over Nordland and Finmark, and, again in the southern part of the kingdom, the tract from the Swedish boundary to Hardangerfiord.

8. The verified charts of the coasts and of the appearances of land already drawn amount to about 400, with descriptions in manuscript.

9. The number of measurements of heights amount at present to about 6500. Up to 1849, these have been published in the second and third volumes of the 'Gæa Norvegica,' and a complete collection up to 1859 is in hand.

10. The following printed maps and charts have left the press :—

A. *Maps*.—Munch, general map of Northern Norway, 2 sheets ; Munthe and Ramm, maps of districts, 6 sheets ; Gjessing, ditto, 8 sheets. B. *Coast Charts*,

with descriptions, &c.—Grove, N. Vibe, and Aubert, Southern Norway, 7 sheets; A. Vibe, ditto, 6 sheets; Schie, ditto, 4 sheets; A. Vibe, Northern Norway, 12 sheets. Total, 45 sheets.

11. Of the above mentioned later maps, and especially of the charts of the coast, many have been published in new and corrected editions. Altogether a number of 20,100 copies have been sold; viz., 3540 maps of districts, 1100 maps by Munch, and 15,460 charts of the coast; and in the office are still in store about 12,000 copies.

12. The fishing-banks and the "Sea-bridge" have been surveyed, and the manuscript records, accompanied by illustrating charts, are preserved in the archives of the office.

13. The measurement of degrees in Finmark is completed, and its results published.

14. The results of the chronometric expedition have likewise been published. During late years the office has received a very considerable collection of printed foreign charts, especially hydrographical. These have chiefly been presented by Government, or by the Geographical Societies of Sweden, Denmark, England, Russia, France, the United States of America, &c.

3. *The Federal Map of Switzerland.* Communicated by PROF. PAUL CHAIX of Geneva, Corresponding Member R.G.S.

THE origin of this great work is due to the triangulation of the western part of Switzerland, undertaken at the end of last century, by M. Tralles, of Berne, for the special purpose of determining systematic laws of refraction from the different altitudes of the mountain summits. About the same time M. Feer, the astronomer at Zürich, with the assistance of M. Pestalozzi, drew from a base line measured on the banks of the river Sihl, near Zürich, a series of triangles to the shores of the Lake of Constance; a great number of their signal stations have, however, been destroyed, and there are no means of finding their sites. In 1811 Professor Trechsel was commissioned by the Government of Berne to triangulate the southern part of that canton, resting upon the base measured at Aarberg by M. Tralles. This work was completed in 1816, and has been revised and embodied in the general triangulation of Switzerland. In 1822 a survey of part of the district of Sargans on the eastern frontier was made and submitted to the Federal Government, which was then deliberating upon the execution of the great topographical map of the Confederation. The work having been decided upon, its execution was entrusted to Quartermaster-general Finsler, who preserved the general management till 1828, when he was succeeded by General Würstenberg, who carried it on till 1833, being in his turn succeeded by Colonel, now General Dufour, by whom it is now being completed.

The map is designed on the scale of $\frac{1}{100000}$ of nature, constructed on Flamsteed's modified projection, and to be completed in twenty-five sheets, each sheet being seventy centimetres long and forty-eight centimetres broad, corresponding to an area of 70,000 metres by 48,000.

Two base lines were measured by M. Tralles, with the assistance of M. Hassle, of Aarau, one near Aarberg, and the other near Thoune; the former was measured twice, once in 1791 and again in 1797, both measurements giving a length of 40,188·5 French feet, and differing from each other by only one-fifth of a foot. In 1832 it was remeasured, owing to a difference of $\frac{3}{305}$ being discovered between the sides of triangles connected with it from a short base measured by M. Feer, near Zürich; this difference was found to be due to